

AYK REGION
NS/K ESC. REPORT # 4

KWINIUK RIVER COUNTING TOWER PROJECT

1967

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Annual Technical Report

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KWINIUK RIVER COUNTING TOWER STUDY

INTRODUCTION

In the Norton Sound district of northwestern Alaska, chum salmon are the most abundant species of salmon and are harvested for commercial and subsistence utilization. It is the goal of fisheries management to allow maximum harvest of salmon that are excess to spawning ground requirements. Estimates of escapement levels are important in the day-to-day management of Norton Sound fisheries and are based mainly on aerial survey counts of key salmon spawning streams.

Objectives of this study, initiated in 1965, are as follows:

1. Evaluate the accuracy of aerial surveys of spawning salmon by comparing aerial counts to tower counts.
2. Evaluate different tower counting methods, e.g., comparison of counts made ten minutes out of each hour to total counts.
3. Determine daily and seasonal timing and magnitude of the runs and environmental factors that may influence salmon behavior.

Studies involving similar objectives have been conducted in Bristol Bay on red salmon primarily. It was decided to conduct this study because of the

importance of chum and pink salmon in Norton Sound and the possibility that these species may exhibit different migration patterns than that for red salmon.

METHODS AND MATERIALS

An aluminum tower was erected during mid-June on a high bank five miles above the mouth of the Kwiniuk River which is located 110 miles east of Nome (Figure 4). Continuous hourly counts (24 hours per day) were made throughout the salmon runs to obtain the total escapement. Ten-minute counts were also made each hour to determine if a reliable estimate of the total escapement could be obtained by counting for shorter time periods.

Daily water temperatures and river depths were measured by the tower crew. Air temperature, precipitation, wind direction and wind velocity were furnished by the FAA station at Moses Point.

Aerial surveys of the river were made with a single engine aircraft, Cessna-180, at an altitude of about 500-700 feet. Two different observers, management biologists, made the counts. Counts were recorded in units of 1, 10, or 100. Surveys were usually made without prior knowledge of the tower counts.

RESULTS

Estimation of Escapements from Tower Counts: In 1967 a total of 26,661 chums, 3,587 pinks, and 13 kings were counted past the tower. Daily and total escapements for the years 1965-1967 are presented in Table 15. The total escapement is the total tower count minus the number of salmon taken above the tower by subsistence fishermen. As a result of high water in mid-June and mid-July and a different path of migration of salmon passing the tower, counts in 1967 were probably not as accurate compared to the 1966 and 1965 counts.

Chum salmon peaked on June 30 and during the period July 5 to July 13 in 1967, but due to high water during July 15-19, large numbers of chums may have moved upstream uncounted. Similarly, it was difficult to determine the peak of the pink salmon run in 1967. During 1966 and 1965 the pink run peaked on or after July 15. Similar to past years, all of the kings in 1967 passed the tower prior to July 15.

FIGURE 4.

KWINIUK RIVER SYSTEM MAP

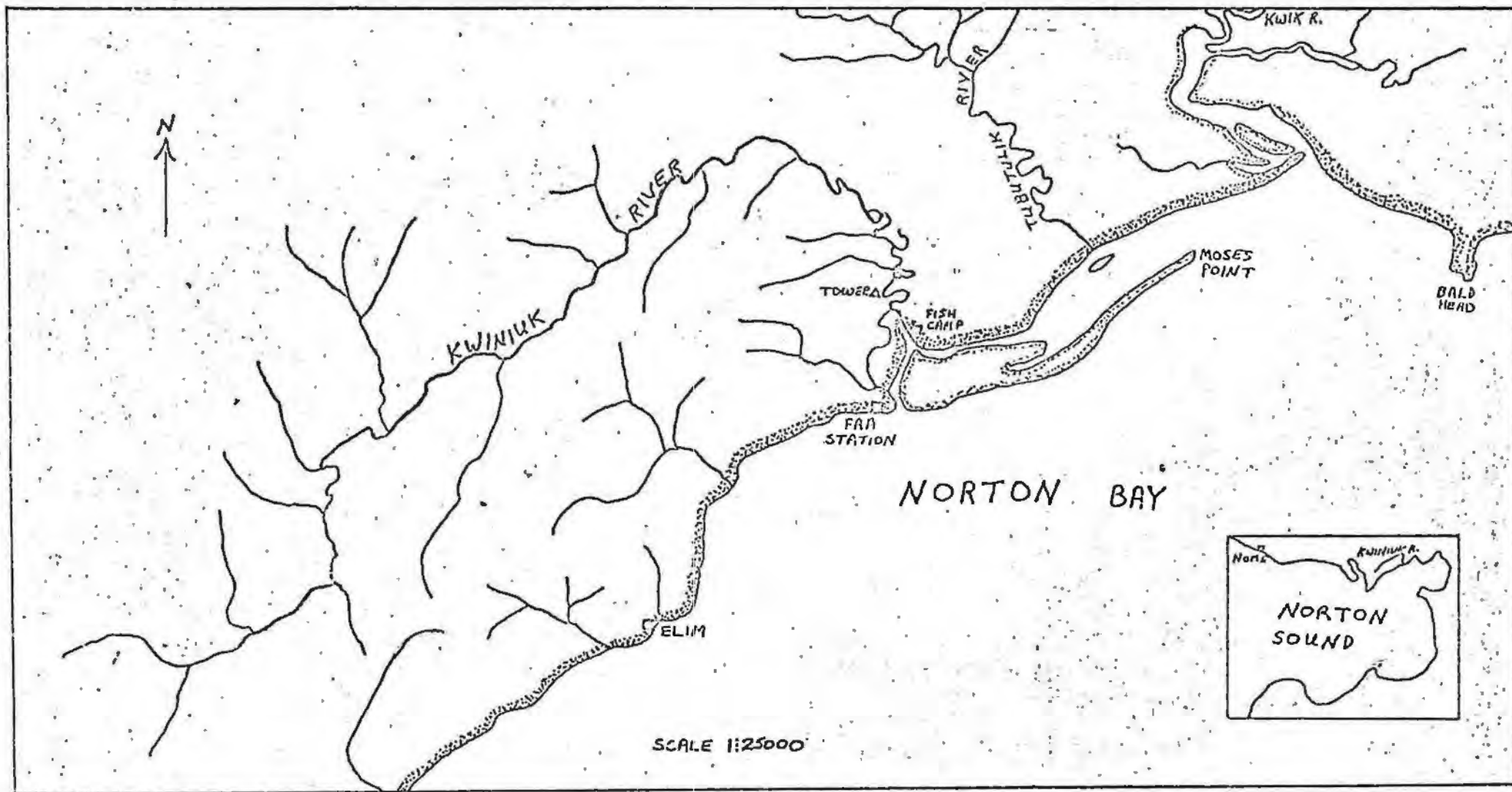


TABLE 15.

KWINIUK RIVER DAILY SALMON ESCAPEMENTS, 1965-67

DATE	CHUMS			PINKS			KINGS		
	1965	1966	1967	1965	1966	1967	1965	1966	1967
6/18	6								
6/19		24							
6/20		26							
6/21		108							
6/22		348							
6/23		253							
6/24		289							
6/25		-451*	5						
6/26		463	19						
6/27		129	53						
6/28	212	508	193	174					1
6/29	765	71	45	86			1	1	
6/30	1,593	412	1,140	-40*			1		3
7/1	869	3,548	693	56		1	1	1	
7/2	4,296	1,891	591	38	11	2	3		1
7/3	1,053	435	288	35	18	1	1		
7/4	1,194	1,996	464	47	288	2			1
7/5	1,062	1,908	2,156	-8*	200				
7/6	1,028	1,226	510	2	16				
7/7	524	519	3,448	22	35	12		1	
7/8	833	2,000	3,403	146	39	27			1
7/9	389	1,800	2,683	92	66	476	2	2	2
7/10	1,806	-31*	2,822	170	10	197			2
7/11	3,517	2,079	2,974	300	39	564	4		
7/12	3,671	4,998	1,972	406	36	644	3		1
7/13	673	2,676	2,706	127	59	759	1		1
7/14	2,953	354	308	1,203	81	453			
7/15	1,582	1,025	22	1,632	307	22	1		
7/16	4,164	-268*	37	2,813	-197*	70		-1*	
7/17	247	508	52	155	198	118		1	
7/18	66	1,121	14	115	565	32			
7/19	358	1,619	27	1,097	1,498	26	1	1	
7/20		570	6		625	26			
7/21		244	50		296	135			
7/22		325	-20*		1,368	20			
7/23		215			1,219				
7/24		92			1,066				
7/25		107			2,172				
7/26		16			676				
7/27		31			107			1	
7/28		-2*			66				
Total Tower Count:	32,861	33,162	25,661	8,668	10,864	3,537	19	7	13
Caught Above Tower by Subsistence Fishermen:	6,227	396	2,217	367	235	79	5	0	0
ESCAPEMENT:	26,634	32,786	24,444	8,301	10,629	3,503	14	7	13

* Fish moved downstream past tower.

Estimate of Total Escapements by 10-Minute Counts: In 1967 ten-minute tower counts of migrating salmon were made each hour for the purpose of comparing the total season estimate of escapements based on hourly and 10-minute counts. Results from a previous 1966 experiment indicated that 10-minute counts may provide a reliable estimate of the season escapement. A summary of the 1966 results are shown below:

1966 EXPERIMENT

	<u>Total Actual Hour Counts</u>	<u>Total Expanded 10-Minute Counts</u>	<u>Relative Error</u>
Chums	27,261	29,692	+ 8.92%
Pinks	10,138	10,770	+ 6.23%

Although the tower counting conditions were extremely unfavorable in 1967, the expanded 10-minute counts provided an estimate of the total escapement that was within acceptable limits when compared to the total hourly counts of the observed escapement. Results of the 1967 experiment are summarized below:

1967 EXPERIMENT

	<u>Total Actual Hour Counts</u>	<u>Total Expanded 10-Minute Counts</u>	<u>Relative Error</u>
Chums	26,520	26,100	- 1.58%
Pinks	3,397	2,982	- 12.22%

The 1966 and 1967 experiments demonstrated that 10-minute counts taken each hour resulted in a reliable estimate of the observed total season escapement. However, ten-minute counts did not provide a reliable estimate of the daily escapement. Therefore, hourly counts were required to obtain an accurate estimate of the daily escapements for the purpose of evaluating the aerial surveys.

Observations of Salmon Behavior: In 1967 the majority of the salmon passing the tower site followed along the opposite shore in contrast to the migration pathway observed in 1966 and 1965. As a result, tower counts were not as accurate as in other seasons when salmon passed close to the tower.

On July 8 during the 1967 season a temporary counting tower was erected along the opposite shore so that the run could be enumerated more effectively. Possible changes in the channel of the river resulting from high levels of discharge in early June may have influenced the migration route of the salmon.

As in 1966 and 1965, chum salmon passed the tower primarily during the mid-afternoon to early morning hours throughout the season. Comparative daily timing of chums passing the tower for the years 1965-67 is illustrated in Figure 5. Pink salmon showed similar patterns of daily migration timing.

Downstream movements of adult salmon past the tower in 1967 was not as pronounced as in 1966. Downstream movements in 1967 occurred mainly during the late morning hours. In 1966 the majority of salmon moving downstream was associated with changes in precipitation levels.

Aerial Surveys: The tower counts recorded during 1967 were probably low due to an undetermined number of salmon passing the tower during unfavorable counting conditions. The number and accuracy of aerial surveys were also limited by unfavorable weather and stream conditions.

Only one aerial survey (July 8) was made under what was considered good counting conditions. On July 8 a total of 15,000 chum salmon was counted as compared to a cumulative tower count of 9,700 for the same date. The very large differences between these two counts indicated that either there were more chum salmon in the river than recorded by the tower crew or that the aerial counts were extremely over estimated.

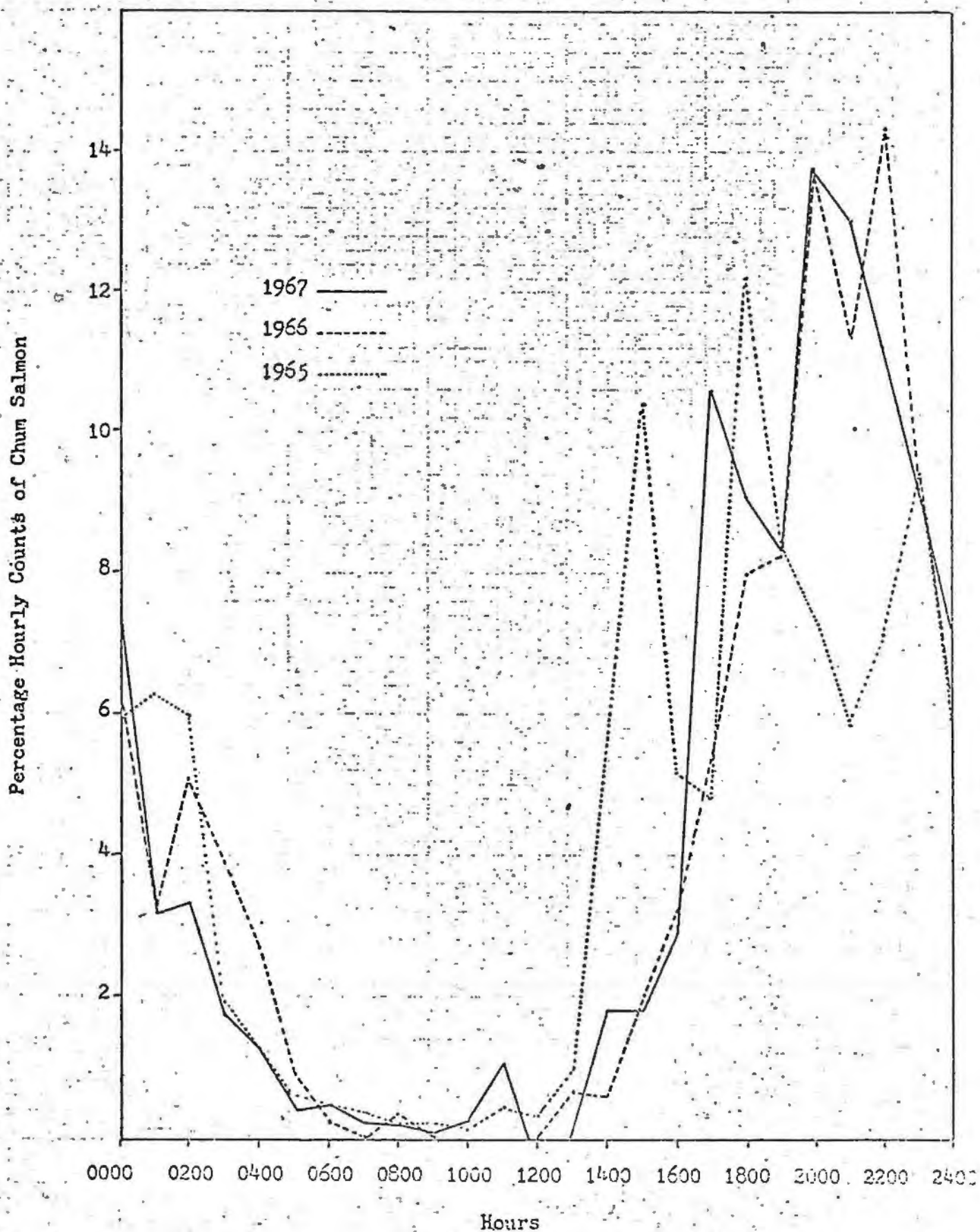
Two other aerial surveys were made on July 17 and July 22 under unfavorable conditions which included heavy sky overcast, slightly turbid water, and on one occasion, the observer encountered a severe case of air-sickness. The small salmon counts (pink and chum salmon combined) obtained during both of these surveys were about one-half that of the recorded tower counts.

DISCUSSION

Due to the very poor tower counting conditions previously mentioned, it was not possible to adequately evaluate the aerial survey method of estimating Kwiniuk River salmon escapements during 1967. As a consequence, little new information was obtained from the 1967 study in regards to providing suggestions for evaluating and improving aerial survey methods.

FIGURE 5.

TIMING OF DAILY MOVEMENTS OF CHUM SALMON PASSING
KWINIUK RIVER COUNTING TOWER, 1965 - 1967



Results of the previous studies (1966 season) indicated that even during good counting conditions, aerial surveys tended to underestimate the actual escapement as indicated by tower counts. In 1966 seven aerial surveys were flown of the Kwiniuk River during various stages of the salmon runs from the early migrating schools to the onset of peak spawning activity. The best survey was made during the latter period when the aerial count represented 74.5 percent of the accumulated tower count of salmon. All surveys in 1966 underestimated the actual number of salmon in the river. The high count or estimate of salmon escapement, usually made near the peak of spawning, is considered as the best index of the total escapement.

As a result of the similarity of the Kwiniuk River to other Norton Sound streams, the run timing and escapement data obtained from this project can generally be applied to the entire Norton Sound district.

SUMMARY

1. For the third year a counting tower project on the Kwiniuk River was operated primarily for the purpose of obtaining an estimate of the total salmon escapement so that aerial survey methods of estimating escapements could be evaluated.
2. Hourly and ten-minute tower counts per hour were made throughout the season.
3. A total of 26,661 chums, 3,587 pinks, and 13 kings were counted passing the tower in 1967.
4. Ten-minute tower counts per hour were shown to provide a reliable estimate of the observed season escapement of chum and pink salmon when compared to the total hourly counts.
5. High, turbid water, inclement weather and a different migration route of salmon passing the tower site were believed to have substantially decreased the accuracy of the tower counts in 1967. In addition, aerial counts were limited by unfavorable counting conditions. As a result, it was not possible to properly evaluate the 1967 aerial survey escapement counts.
6. Results from previous 1966 studies indicated that aerial survey counts tended to underestimate the actual escapement as indicated by tower counts.

7. The 1967 chum salmon migration peaked on June 30 and during the period July 5-13 but due to high water, it was difficult to pinpoint the peak of the pink salmon migration timing which peaked on or about July 15 during previous years.
8. In 1967, as in 1966 and 1965, salmon passing the tower traveled mainly during the mid-afternoon to early morning hours.